THE CLINGING MECHANISM OF *PSEUDOPHRYNE BIBRONI* (ANURA: LEPTODACTYLIDAE) TO AN ALGA ON GLASS

by N. GRADWELL*

Summary

GRADWELL, N. (1975).—The clinging mechanism of *Pseudophryne bibroni* (Anura: Leptodactylidae) to an alga on glass. *Trans. R. Soc. S. Aust.* **99**(1), 31-34, 28 February, 1975.

Despite the absence of an oral sucker, tadpoles of all stages from 26 to 40 (of Gosner 1960) were found to be capable of clinging by their jaws to an alga on vertical glass. When the glass was wiped clean of the alga, *Phyllobium* sp., tadpoles were no longer able to attach themselves. Therefore substratum algae are necessary for the clinging of the tadpoles to glass.

As the nares appear to suffice as inhalent channels, the dental apparatus of tadpoles is adapted to maintain a firm grip on the alga. There is an absence of peripheral papillae adjacent to the most posterior of the tooth rows of the lower lip. Therefore this tooth row can bend farther forward and the security of its grip on the alga is probably increased.

Introduction

It is well known that anuran tadpoles are adapted to occupy a wide variety of ecological niches (Noble 1931, Orton 1953). Of the morphological adaptations, an attachment mechanism for clinging to substrata is a predictable association with a lotic habitat. It is thus possible to avoid dislodgement by swift currents even in torrential streams. In contrast, the adhesive secretion produced by the ventral glands of most young embryos (at stages 18 to 24, of Gosner 1960) is too weak to withstand fast currents (Gradwell, unpublished). There is no published evidence that these glands can produce subambient hydrostatic pressures. They atrophy after stage 24, and in the tadpole which represents stages 25 to 40, either of two kinds of non-glandular sucker may develop.

An oral sucker is the most usual adaptation in lotic tadpoles and, accordingly, the degree of development of this sucker would seem to be influenced by the velocity of the ambient water. In most lotic species the periphery of the upper and lower lips is continuous and forms a suctorial disc, and the number of tooth rows increases progressively with the velocity of the ambient water (Noble 1931; Gradwell, unpublished). The structure and function of a tadpole's oral sucker has been described in *Ascaphus truei* (Gradwell 1971, 1973) and it has been compared with the suckers of five Australian species (Gradwell 1975). In addition, Tyler (1963) described the external appearance of the sucker of *Litoria arfakiana* (as *Hyla angularis*), which is much like that of *Ascaphus*.

Another type of tadpole sucker is that which lies posterior to the mouth. The anatomy of such a sucker has been described in *Staurois ricketti* by Noble (1931) and in *Staurois afghana* (Bhaduri 1935). No data are available on the magnitude of its suction, except that if a tadpole is manually lifted out of the water by its tail, its sucker can support a stone sixty times the weight of the tadpole (Hora 1922).

The present paper reports a mechanism employed by lentic tadpoles of the Australian leptodactylid frog *Pseudophryne bibroni* which enables them to cling to a vertical substratum, even though they lack a sucker. I have observed such ability in nature for many other suckerless tadpoles and have assumed that they use their teeth to secure a grip on rocks.

Results and Discussion

On 18 July 1974, 16 tadpoles of *Pseudophryne bibroni* (at stages 26 to 29) were collected in a flooded ditch (ca 30 m long by 5 m wide) with sides sloping to a depth of 2.5 m. This habitat is about a kilometre from Boyd

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Fig. 1. *A*. The tadpole of *Pseudophryne bibroni* (stage 36) clinging to algae on the vertical glass side of an aquarium. *B*. Oral apparatus of a clinging tadpole as seen through a thin transparent layer of the alga *Phyllobium* sp. growing on the aquarium glass. As the lower beak is enclosed within the upper beak, only the latter is visible. The lower labial teeth are inclined forward to grip the algae. Adduction is accomplished by a slight lateral compression of the lips and teeth. *C*. The oral apparatus dissected free from a tadpole to show the beaks in an open condition. Calibration bars = 1 mm.

River Crossing, near Jenolan Caves, N.S.W. The maximum depth of water was 0.5 m and the bottom consisted of mud and fallen *Eucalyptus* leaves and bark. At 3.00 p.m. the water temperature was 6 to 8°C. Five hours later, the tadpoles were placed in an aerated aquarium at approximately the same temperature.

For initial identification, the mouthparts of the tadpoles were examined and compared with the description of Martin (1965). Because the absence of a sucker was noted, it was surprising to observe that all of the tadpoles clung to the vertical glass sides of the aquarium (Fig. 1A). This attachment was insecure, for these tadpoles were sometimes displaced from their clinging sites when other tadpoles collided with them. Examination of the oral region of a clinging tadpole, by stereomicroscope through the glass, showed that the lower beak was kept closed within the edge of the upper beak (Fig. 1B) and that the upper and lower tooth rows were held adducted, though not touching one another. The nares were the only inhalent channels for gill irrigation.

During preparations for photography it was found that the inside of the glass aquarium was covered with a thin layer of algae which prevented sharp focussing on the mouth and teeth. Therefore, half of one side of the aquarium was cleaned of its algae, and a camera conveniently positioned to await the settling and clinging of a tadpole on the cleaned glass. Although tadpoles attempted to cling to the cleaned glass, they were unsuccessful. However, they clung readily to the uncleaned glass, demonstrating the presence of algae on the glass to be necessary for the clinging of these tadpoles.

Apart from clinging to the glass, the tadpoles also showed frequent feeding movements over the glass during which their jaws opened and closed rhythmically in a scraping action. Figure 1C shows the jaws in an open condition and both the upper and lower beaks are visible. The predominant alga growing on the glass was *Phyllobium* sp. (identified from Prescott 1970), which has a thallus of branched strands. At the ends of the strands are swellings called akinetes, which contain chloroplasts. It was of special interest to find akinetes in the manicotto ("stomach") of tadpoles, which suggests that they had been grazed off the glass. It would also seem that the bulbous akinetes on their strand-like thallus could easily be gripped by the minute sharp teeth of tadpoles, thus providing anchorage. It is possible that other filamentous algae may also permit the clinging of these tadpoles to substrata.

There are no papillae behind the most posterior row of lower labial teeth. Therefore this row of teeth can bend farther forward than if papillae were present here and so the teeth can grip substratum plants more firmly. However, some other suckerless tadpoles (for example, *Litoria verreauxi*) can cling feebly to vertical substrata in similar fashion even though they lack a posterior gap in their peripheral papillae.

Four tadpoles were raised into juvenile frogs. Until stage 40, the tadpoles (entire length, 36.0 mm; snout-to-vent length, 17.4 mm) were able to cling by their teeth to the substratum. After this stage the beaks and teeth were shed prior to widening of the mouth.

It is proposed here that *Pseudophryne bibroni* tadpoles are able to cling to vertical substrata by biting their teeth into algae and perhaps other vegetation. As the narial inflows appear to be sufficient for respiration, the jaws need not open and close rhythmically to admit additional water, but can maintain their bite on plants. However, I have not had the opportunity to compare these findings with the ability of *P. bibroni* in their natural habitat to cling to substrata. The absence of an oral sucker in these tadpoles confers greater flexibility on the jaws and perhaps it broadens their food resources. On the other hand, an oral sucker in lotic tadpoles facilitates grazing on algae in swift currents (Gradwell 1971), where more tenacious gripping is needed.

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